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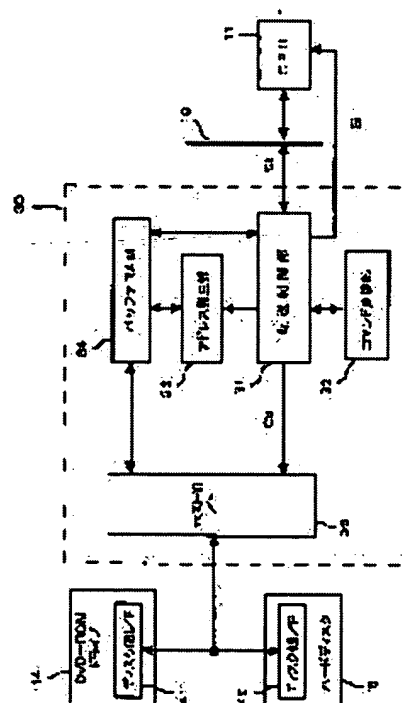
(54) NAVIGATION SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a navigation system capable of smoothly performing navigation with a reduced processing burden by mounting a hard disk for storing map data transferred from a recording medium.

SOLUTION: When a CPU 11 of the navigation system sends out a transfer command signal St to a transfer interface part 30, a command conversion part 32 produces, under control of a transfer control part 31, a plurality of commands Cd that can be identified by an external disk device based on the command signal St. The map data recorded in a DVD-ROM 1 is read out by a DVD-ROM drive 14 and temporarily held at a specified address of a buffer RAM 34. The map data is read out from the buffer RAM 34 and stored in the hard disk 15.

The address by which the buffer RAM 34 is accessed is given by an address generating part 33. By this, desired map data is transferred to the hard disk 15 and, from this on, navigation can be performed using the map data in the hard disk 15.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention belongs to the technical field of the navigation system equipped with the hard disk which stores map data especially about the navigation system which performs navigation using the map data recorded on the record medium.

[0002]

[Description of the Prior Art] The navigation system which carries a DVD-ROM drive and a CD-ROM drive, reads from the former the map data recorded on DVD-ROM and CD-ROM as a record medium, and performs navigation actuation is used widely. In such a navigation system, in case navigation actuation is performed, a self-vehicle location is detected, the map data of the car circumference are read from a record medium, and the map image created based on map data is displayed on the display screen with the mark which shows a self-vehicle location.

[0003]

[Problem(s) to be Solved by the Invention] By the way, since record media, such as DVD-ROM which recorded music data and image data in the format of DVD-Video or DVD-Audio, are offered, there are needs to reproduce while operating such a record medium. However, it will always be necessary to insert in a drive the record medium which recorded map data during navigation actuation, and a DVD-ROM drive etc. will be occupied in the above-mentioned conventional navigation system. For this reason, it was difficult to use a DVD-ROM drive etc. for other applications.

[0004] On the other hand, apart from the above-mentioned record medium, carrying a hard disk in a navigation system is also considered as a storage means of a non-volatile with large capacity. And if the whole DVD-ROM etc. data are installed on a hard disk the whole round head and map data are read from a hard disk on the occasion of navigation actuation, a DVD-ROM drive etc. can be used for other applications. Moreover, since the access rate of a hard disk is high-speed, it has a merit also in respect of high-speed drawing of the display screen.

[0005] However, its actuation is troublesome for a user while the install activity to a hard disk from record media, such as DVD-ROM, requires most time amount. Moreover, DVD-ROM is an one layer type thing of one side, and is a 4.7 G bytes and one side two-layer type thing, and since it is the large capacity of 8.5 G bytes, when it is necessary to secure the storage region of the part hard disk and utilizes a hard disk for other applications, its futility increases, for example.

[0006] On the other hand, the thing [performing a map data transfer to a hard disk from record media, such as DVD-ROM, if needed during navigation actuation] makes the processing engine performance of a navigation system fall remarkably. That is, if CPU of a navigation system always controls transfer processing, a processing burden will become excessive, for example, trouble will be produced in display processing at the time of navigation actuation. Moreover, when once transmitting via a buffer, an internal bus will be occupied and trouble is produced also in an exchange of other data. Thus, the point that map data transfer processing to the above hard disks from the constraint on the processing in a navigation system could not be performed freely was a problem.

[0007] Then, while this invention is made in view of such a problem, a hard disk is carried in a navigation system and required map data are automatically transmitted to a hard disk, an excessive burden is not applied to CPU but it aims at offering the navigation system which does not have a bad influence on other processings.

[0008]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, a navigation system according to claim 1 A self-vehicle location detection means to detect a self-vehicle location, and the 1st storage means which reads these map data from the record medium with which map data were recorded, The writing of map data, and the 2nd storage means of a non-volatile which can be read, The navigation control means which controls the navigation actuation according to said self-vehicle location using map data, and sends out the map data transfer command to said 2nd storage means from said 1st storage means to predetermined timing, It is characterized by having read-out of the map data from said 1st storage means, and a transfer interface means to control the map data transfer to said 2nd storage means, according to said transfer command.

[0009] According to this invention, the navigation system is equipped with the 1st storage means which used record media, such as DVD-ROM and CD-ROM, and the 2nd storage means, such as a hard disk. While controlling the navigation actuation according to a self-vehicle location using map data, a navigation control means sends out a map data transfer command to a transfer interface means, if it becomes predetermined timing. According to the received transfer command, map data are read from the 1st storage means, and it controls by the transfer interface means to be transmitted to the 2nd storage means.

[0010] Therefore, when map data are transmitted to the 2nd storage means, navigation actuation can be continued even if it always does not set to the 1st storage means the record medium with which map data were recorded. And since map data are transmitted automatically and it does not need to be placed between the subsequent transfer processings itself by the navigation control means by transfer command, the load of processing does not increase but can perform processing required for navigation smoothly. Therefore, it becomes possible to perform transfer processing and to use map data effectively, without affecting processing of a navigation system.

[0011] The map data with which the navigation system according to claim 2 was read from said 1st storage means in the navigation system according to claim 1 are characterized by being transmitted to said 2nd storage means through said transfer interface means.

[0012] According to this invention, on the occasion of map data transfer processing, a transfer interface means acquires the map data read from said 1st storage means, and transmits them to the 2nd storage means as it is. Therefore, since map data are transmitted by the transfer interface means, without going via an internal bus etc., they do not cause trouble to the I/O through the internal bus of data required for other processings etc.

[0013] A navigation system according to claim 3 is characterized by equipping said transfer interface means with a command conversion means by which change the format of said transfer command and said 1st storage means and said 2nd storage means generate an identifiable command, and the transfer control means which controls the transfer operation from said 1st storage means to said 2nd storage means based on said command in a navigation system according to claim 2.

[0014] According to this invention, on the occasion of map data transfer processing, a transfer interface means changes the format of the received transfer command, generates the command of predetermined interface specification, reads map data from the 1st storage means according to this command, and transmits and stores them in the 2nd storage means. Therefore, since a transfer command is automatically changed into a desired command, without a navigation control means controlling each storage means according to an individual, the load of the processing accompanying navigation control is mitigated further.

[0015] Navigation according to claim 4 is further equipped with a memory means by which said transfer interface means holds map data temporarily, in a navigation system according to claim 3, and said transfer control means is characterized by controlling the transfer operation from said 1st storage means

to said memory means, and the transfer operation from said memory means to said 2nd storage means based on said command.

[0016] According to this invention, on the occasion of map data transfer processing, a transfer interface means reads map data from the 1st storage means, it holds and reads map data from a memory means to a memory means continuously, and transmits and stores them in the 2nd storage means. Since map data are transmitted via the memory means as a buffer, a map data transfer can be certainly performed to desired timing.

[0017] A navigation system according to claim 5 is characterized by dividing map data into the predetermined unit amount of data, performing transfer operation, repeating the transfer operation of this unit amount of data two or more times, and transmitting map data by said transfer control means in a navigation system according to claim 3.

[0018] According to this invention, using general interface specification, the 1st storage means and the 2nd storage means, and connection are possible for a transfer interface means, and it can change the count of a transfer of the unit amount of data, and can control the whole transfer amount of data easily.

[0019] A navigation system according to claim 6 is characterized by for said command conversion means changing the format of said transfer command, and generating said two or more commands in a navigation system according to claim 3.

[0020] Since according to this invention two or more commands are generated corresponding to a transfer command and the transfer operation of the 1st storage means and the 2nd storage means is controlled by this, a navigation control means does not need to direct the fine processing in transfer operation according to an individual, and can simplify processing.

[0021] In a navigation system according to claim 5, said unit amount of data carries out abbreviation etc., and a navigation system according to claim 7 is in it at the storage capacity of said memory means, and is characterized by things.

[0022] According to this invention, since a transfer interface means controls transfer operation using a memory means to have storage capacity almost equal to the unit amount of data, it can stop the storage capacity of a memory means to the minimum, and can attain low cost-ization.

[0023] A navigation system according to claim 8 is characterized by equipping said transfer interface means with an address generation means to generate the address at the time of said transfer control means accessing said memory means, further in a navigation system according to claim 4.

[0024] According to this invention, when a transfer control means controls a transfer, the predetermined address is generated by the address generation means, the address with which a memory means corresponds is accessed, and transfer data are outputted and inputted. Therefore, that a transfer control section should just give the existence and the transfer amount of data of transfer operation to an address generation means, time and effort, such as address computation, is saved and transfer processing is simplified.

[0025] A navigation system according to claim 9 is characterized by outputting the signal which makes it distinguish that the map data transfer ended said transfer control means to said navigation control means in a navigation system according to claim 3.

[0026] According to this invention, predetermined signals, such as an interrupt signal, are outputted from a transfer control section to timing in case the map data transfer processing by the transfer interface means is completed, and distinction of transfer termination of the navigation control means which received this is attained. Therefore, a navigation control means can shift to the next processing immediately after transfer termination, and navigation actuation quickens.

[0027] A navigation system according to claim 10 is characterized by writing and read-out of map data being possible in a navigation system according to claim 1 at an access rate with said 2nd storage means more nearly high-speed than said 1st storage means.

[0028] According to this invention, since the access rate is high-speed compared with the 1st storage means, the 2nd storage means can read map data from the 2nd storage means after a map data transfer in a short time according to a read-out command, and can perform high-speed navigation actuation.

[0029] A navigation system according to claim 11 is characterized by said 2nd storage means being a

hard disk drive unit in a navigation system according to claim 10.

[0030] According to this invention, since a hard disk drive unit is used as the 2nd storage means, while being a high speed and large capacity, map data can be transmitted to the high storage means of versatility, and it can utilize for it.

[0031] It is characterized by recording the block map data for every unit block with which the navigation system according to claim 12 divided the whole map into said record medium in the navigation system given in either of claim 1 to claims 4, and for said transfer interface means reading said block map data, and transmitting to said 2nd storage means.

[0032] According to this invention, the map data recorded on a record medium divide a whole map into a unit block, the block map data about each unit block come to gather, and an interface means transmits each block map data. Therefore, since what is necessary is for a transfer interface means to be able to perform map data transfer processing uniformly, and just to perform storage capacity of a memory means, and generation of a command according to a fixed pattern, control becomes easy.

[0033] A navigation system according to claim 13 is characterized by equipping said transfer interface means with said memory means to have the storage capacity which can hold said at least one block map data in a navigation system according to claim 12.

[0034] According to this invention, transfer processing of an interface means is performed by the procedure of reading and transmitting one block map data from a memory means, after reading one block map data and holding for a memory means. Therefore, if the same transfer operation is repeated to each block map data, required map data can be transmitted, transfer processing becomes easy, and the storage capacity of a memory means can be stopped.

[0035] A navigation system according to claim 14 is characterized by making applicable to a transfer the block map data which judge whether the block map data with which said navigation control means serves as a candidate for a transfer are already stored in said 2nd storage means, and are not stored in said 2nd storage means in it in a navigation system according to claim 12.

[0036] According to this invention, in case block map data were transmitted, the navigation control means distinguished the existence of storing of the block map data in the 2nd storage means, and only when not stored, it sent out the transfer command about the block map data to the 2nd storage means. Therefore, unnecessary transfer processing is avoided and it becomes possible to perform transfer processing promptly.

[0037] A navigation system according to claim 15 is characterized by making applicable to a transfer the field which consists of two or more circumference unit blocks on the basis of said unit block including a self-vehicle location by said navigation control means in a navigation system according to claim 12.

[0038] According to this invention, a navigation control means sends out a transfer command about the block map data corresponding to within the limits of the unit block around a self-vehicle location on the basis of the unit block with which a self-vehicle location is included. Therefore, block map data can be transmitted to the 2nd storage means in advance about the high unit block of possibility that the car under transit will pass.

[0039] It is characterized by making applicable to a transfer the field where a navigation system according to claim 16 consists of two or more unit blocks with which said navigation control means laps on the optimal path from a self-vehicle location to the destination in a navigation system according to claim 12.

[0040] If the optimal path which reaches the desired destination is set up according to this invention, a navigation control means sends out a transfer command about the block map data corresponding to within the limits of two or more unit blocks which lap on an optimal path along the destination from a self-vehicle location. Therefore, block map data can be beforehand transmitted to the 2nd storage means about the unit block which is planning that the car under transit passes in advance.

[0041] It is characterized by making applicable to a transfer the predetermined field where the navigation system according to claim 17 was demarcated in the navigation system according to claim 1 according to the self-vehicle location where said navigation control means was detected by said self-vehicle location detection means.

[0042] According to this invention, the predetermined field according to the self-vehicle location detected by the self-vehicle location detection means is demarcated, the map data corresponding to this field are read, and a transfer command is sent out by the navigation control means to predetermined timing. Therefore, since the candidate for a transfer can be limited, while being able to finish transfer processing quickly, possibility that the area it runs frequently will be transmitted becomes high, and the utility value of the map data stored in the 2nd storage means can be raised.

[0043] A navigation system according to claim 18 is characterized by said navigation control means sending out said transfer command of map data, whenever a car moves only predetermined distance in a navigation system according to claim 1.

[0044] According to this invention, a transfer navigation control means is the timing to which the car ran and the self-vehicle location moved only predetermined distance, a transfer command is sent out to a transfer interface means, and map data transfer processing is performed as mentioned above according to this. Therefore, since the predetermined field used as the candidate for a transfer can transmit to the timing which changes mostly by making it agree easily, transfer processing can be performed smoothly.

[0045] As for said navigation control means, a navigation system according to claim 19 sends out the read-out command of map data in a navigation system according to claim 1, and said transfer interface means is characterized by reading map data from said 1st storage means or said 2nd storage means according to said read-out command.

[0046] According to this invention, a navigation control means is read in order to obtain map data required for navigation, a command is sent out to a transfer interface means and a transfer interface means by which this read-out command was received reads required map data from the 1st storage means or the 2nd storage means. Therefore, a transfer interface means can be shared to read-out processing of map data, without establishing other read-out means, and comfortable navigation can be performed using map data, without causing complication of a whole configuration.

[0047] A navigation system according to claim 20 A self-vehicle location detection means to detect a self-vehicle location, and the 1st storage means which reads these map data from the record medium with which map data were recorded, The writing of map data, and the 2nd storage means of a non-volatile which can be read, The transfer interface means which reads map data for the map data recorded on said record medium from said 1st storage means or said 2nd storage means according to the read-out command of map data, The navigation actuation according to said self-vehicle location is controlled using the map data read by said transfer interface means, and it is characterized by having the navigation control means which sends out said read-out command to predetermined timing.

[0048] According to this invention, if a navigation control means becomes predetermined timing in navigation actuation, it sends out the read-out command of map data to a transfer interface means. With a transfer interface means, the received map data which were read, read map data and were read from the 1st storage means or the 2nd storage means in the navigation control means according to the command are used for a display process etc., and navigation actuation is performed. Therefore, navigation can be performed smoothly, acquiring map data and pressing down the load of processing without performing complicated processing by read-out command.

[0049] A navigation system according to claim 21 is characterized by adding the identification information which identifies whether map data are read from said 1st storage means, or it reads from said 2nd storage means to said read-out command in a navigation system according to claim 20.

[0050] According to this invention, a transfer interface means reads map data from the storage [which was received according to the same operation as invention according to claim 18] means which reads, and acquires identification information from a command and this identification information shows. Therefore, the storage means which should read map data can be specified easily, and read-out processing of map data can be simplified further.

[0051]

[Embodiment of the Invention] Hereafter, the gestalt of suitable operation of this invention is explained based on a drawing.

[0052] Drawing 1 is the block diagram showing the whole navigation system configuration concerning

this operation gestalt. With CPU11, ROM12 and RAM13, DVD-ROM drive 14, a hard disk 15, the sensor section 16, the GPS receive section 17, an interface 18, an input device 19, a display 20, a display and control section 21, buffer memory 22, the speech processing circuit 23, and the loudspeaker 24, the navigation system shown in drawing 1 is equipped with the transfer interface section 30, and is constituted.

[0053] In drawing 1, CPU11 controls actuation of the whole navigation system. It connects with each component of a navigation system through the internal bus 10, and data and a control signal are outputted [CPU11] and inputted via an internal bus 10 to suitable timing. Moreover, it performs a control program, CPU11 reading the control program stored in ROM12 via an internal bus 10, and holding the data under processing to RAM13 temporarily. In addition, CPU11 functions as a navigation control means of this invention.

[0054] DVD-ROM drive 14 functions as the 1st storage means of this invention, equips with DVD-ROM1 which memorizes map data, and performs read-out actuation of this map data. DVD-ROM1 is an one layer type thing of one side, is a 4.7 G bytes and one side two-layer type thing, and is a mass record medium of 8.5 G bytes, the pit corresponding to record data is formed on the disk, and record data are read using pickup of DVD-ROM drive 14.

[0055] The map data which contain road configuration data required for navigation actuation in DVD-ROM1 are memorized, and various associated data related further, such as facility data and name data, is matched with road configuration data, and is memorized. With this operation gestalt, a whole map is divided into the block as a mesh-like unit field, the map data corresponding to each block are managed as block map data, and two or more block map data are recorded on DVD-ROM1.

[0056] Drawing 2 is drawing explaining the concept of the block which is the division unit of the map data of DVD-ROM1. As shown in drawing 2 R> 2, it divides into M pieces in the direction of east and west, they divide the whole map top field into a mesh-like block in the N directions of north and south, respectively, and the map data of DVD-ROM1 are managed. It is the i-th from the west, and a block (i, j) will be defined as the j-th block from north, the blocks of the same configuration of a MxN individual will gather by all from the block (1 1) of a northwestern edge to the block (M, N) of a southeast edge, and the whole map data will consist of drawing 2 R> 2.

[0057] In addition, although drawing 2 explains as that whose block of each unit the whole map top is a rectangle field and is also a rectangle field further, the map which has a complicated whole configuration may be treated in fact, and each block configuration is not restricted to the same configuration, either. In the following explanation, since it is easy, each block shall be the rectangle field of the same configuration, but even when becoming a more complicated block configuration, application of this invention is possible.

[0058] Moreover, drawing 3 is drawing showing an example of the DS in the case of recording the map data of the block unit shown in drawing 2 on DVD-ROM1. In drawing 3, the road configuration data of each block and the associated data which accompanies this shall be contained in each block map data, and for every block, a specific name is given and it is distinguished. About each block of a MxN individual, a sequential array is carried out and block map data are recorded on DVD-ROM1. The order of data of the block map data shown in drawing 3 is an example, and even if it memorizes in order of different data from this, it does not interfere. Moreover, you may memorize to a different storage region for every data classification of each block.

[0059] Returning to drawing 1, a hard disk 15 is the storage of the non-volatile which performs read-out and the writing of various data, such as map data, and functions as the 2nd storage means of this invention. In this operation gestalt, the hard disk 15 is available for many applications, and can store various data, such as music data, image data, and an application program. Some hard disks 15 are assigned as map data storage area 15a, and it is used as a field for transmitting and storing the map data of DVD-ROM1 via the transfer interface section 30. For example, what is necessary is just to assign about 1-2 G bytes of a hard disk 15 to map data storage area 15a. If the capacity of a hard disk 15 becomes large, it cannot be overemphasized that the big storage capacity as map data storage area 15a is securable. Moreover, it is also possible to set the storage capacity of map data storage area 15a as

arbitration by the user. In addition, about the detail of the map data transfer to a hard disk 15, it mentions later.

[0060] The sensor section 16 is constituted including various sensors required in order to detect a self-vehicle location. Specifically, the speed sensor for detecting the run state of a car, the mileage sensor, the bearing sensor, etc. are included. The GPS receive section 17 receives the electric wave from a GPS (Global Positioning System) satellite, and outputs positioning data. The sensor section 16 and the GPS receive section 17 function as CPU11 as a self-vehicle location detection means of this invention conjointly.

[0061] An interface 18 performs interface actuation between the sensor section 16 and the GPS receive section 17, and CPU11, and self-vehicle location data are called for by CPU11 based on the positioning data from the sensor output and the GPS receive section 17 from the sensor section 16. This self-vehicle location data is collated with the above-mentioned map data by CPU11, and is amended using map matching processing etc.

[0062] In order that an input device 19 may consist of remote control equipped with the key section prepared in the navigation system body, or the key section etc. and may operate the request in navigation actuation, it supplies the signal according to a key input to CPU11.

[0063] A display 20 is a display means used for navigation actuation, for example, consists of CRT, a liquid crystal display component, etc. While map data are displayed in various modes according to control of a display and control section 21, it superimposes on this and a self-vehicle location is displayed on a display 20 as a car mark. Moreover, a display and control section 21 generating the indicative data displayed on a display 20, and saving it temporarily at buffer memory 22, it reads an indicative data from buffer memory 22 to proper timing, and it carries out a display output to a display 20.

[0064] The speech processing circuit 23 generates a predetermined sound signal under control of CPU11. The external output of the sound signal amplified by suitable level in the speech processing circuit 23 is carried out from a loudspeaker 24. As such a sound signal, there is guidance voice for guiding the path of a car, for example.

[0065] The transfer interface section 30 as a transfer interface means of this invention transmits the map data which are proper timing and were recorded on DVD-ROM1 at the time of navigation actuation from DVD-ROM drive 14 to map data storage area 15a of a hard disk 15 under control of CPU11.

Moreover, the transfer interface section 30 reads map data from DVD-ROM1 or a hard disk 15 under control of CPU11, and outputs them via an internal bus 10 for the display process to a display 20 etc.

[0066] Here, the outline configuration of the transfer interface section 30 is explained using the block diagram of drawing 4. As shown in drawing 4 R> 4, the transfer interface section 30 is constituted including the transfer control section 31, the command transducer 32, the address generation section 33, and a buffer RAM 34 and the host side interface 35.

[0067] The transfer control section 31 as a transfer control means of this invention performs interface actuation which followed reception and this transfer command signal St in the transfer command signal St through an internal bus 10 from CPU11. The read-out command signal which directs data read-out to DVD-ROM drive 14 or a hard disk 15 as a command signal sent out from CPU11 in addition to the transfer command signal St which directs the data transfer from DVD-ROM drive 14 to a hard disk 15, the write-in command signal which directs the data writing to a hard disk 15 are included. Among these, the transfer command signal St which directs the data transfer from DVD-ROM drive 14 to a hard disk 15 corresponds to the transfer command of this invention.

[0068] Moreover, the transfer control section 31 controls actuation of the command transducer 32, the address generation section 33, and the host side interface 35, and controls the transfer interface section 30 whole in the gross. Moreover, the transfer control section 31 controls the data I/O between a buffer RAM 34 and an internal bus 10. Furthermore, the transfer control section 31 outputs interrupt signal Si to CPU11 to predetermined timing, such as the time of transfer termination.

[0069] The transfer control section 31 interprets the transfer command signal St received from CPU11, and changes and outputs the command transducer 32 as a command conversion means of this invention

to the command Cd of the format that DVD-ROM drive 14 and a hard disk 15 can be recognized. Usually, the command group which consists of two or more commands Cd corresponding to one transfer command signal St is generated. Therefore, the command transducer 32 holds each generated command Cd temporarily, according to control of the transfer control section 31, is predetermined timing and sends it out to DVD-ROM drive 14 or a hard disk 15. As a classification of the command Cd generated, there are a lead command which directs read-out, a light command which directs writing.

[0070] The address generation section 33 as an address generation means of this invention generates the address at the time of accessing a buffer RAM 34 under control of the transfer control section 31. For example, when performing read-out or the writing to a buffer RAM 34, according to data size required for one read-out or writing, the address is changed serially, and the address of a buffer RAM 34 is always kept proper.

[0071] A buffer RAM 34 functions as a memory means for reading the data held to a buffer RAM 34 in the case of the writing to the DVD-drive 14 or a hard disk 15 while writing in temporarily the DVD-drive 14 or the read-out data from a hard disk 15. As mentioned above, the access timing of a buffer RAM 34 becomes settled depending on the sending-out timing of the command Cd by the transfer control section 31, and the address of read-out to a buffer RAM 34 or writing is prescribed by the address generation section 33.

[0072] What is necessary is here, just to give larger storage capacity than the minimum unit amount of data which can be written [read-out/] in in to DVD-ROM drive 14 or a hard disk 15 to a buffer RAM 34. Actually, it is desirable to consider as the integral multiple of this minimum unit amount of data. Of course, it is good also as a mass buffer RAM 34 which can memorize not only this but one map block, and still more nearly another buffer memory may be added and large-capacity-ized in the transfer interface section 30.

[0073] The host side interface 35 performs interface actuation so that DVD-ROM drive 14 and a hard disk 15 may suit the disk side interfaces 41 and 42 which it has, respectively. As shown in drawing 4, the host side interface 35 of the transfer interface section 30, the disk side interface 41 of DVD-ROM drive 14, and the disk side interface 42 of a hard disk 15 are connected mutually.

[0074] As interface specification for connecting between the host side interface 35 and each disk side interfaces 41 and 42, SCSI (Small Computer System Interface) and ATAPI (AT Attachment Packet Interface) can be used, for example. SCSI is the standard specification for connecting the peripheral device with a computer. ATAPI is specification which also makes connectable peripheral devices other than a hard disk based on IDE (Integrated Drive Electronics) which is the specification for connecting a hard disk. What is necessary is to define the predetermined command to the device connected, respectively, and just to determine that the above-mentioned command Cd corresponds to each specification in SCSI and ATAPI.

[0075] Next, the map data transfer processing to the hard disk 15 performed in a navigation system is explained with reference to drawing 5 - drawing 8. Here, in the car under transit, the transfer processing performed when DVD-ROM drive 14 is equipped with DVD-ROM1 which recorded map data and navigation actuation is being performed is explained.

[0076] Drawing 5 is a flow chart which shows the flow of the whole transfer processing concerning this operation gestalt. Initiation of processing of drawing 5 detects a self-vehicle location at step S1. That is, it asks for the self-vehicle location data containing the LAT and LONG based on the positioning data from the sensor output and the GPS receive section 17 from the sensor section 16.

[0077] Subsequently, in step S2, based on the self-vehicle location data for which it asked at step S1, the migration length from a location which performed the last transfer processing is found, and it distinguishes whether the predetermined distance set up beforehand was exceeded. That is, although the activation timing of transfer processing can be set up variously, in this operation gestalt, transfer processing is performed to the timing to which the car moved only predetermined distance. In addition, whenever a car moves from a block besides this, transfer processing may be performed, or transfer processing may be performed to the timing to which predetermined time passed.

[0078] When the migration length of a car has not reached predetermined distance as a result of decision

of step S2 (step S2; NO), transfer processing is not performed but it still returns to step S1. On the other hand, when the migration length of a car reaches predetermined distance (step S2; YES), it moves to step S3.

[0079] At step S3, it judges whether the optimal path which reaches the desired destination in a navigation system is set up. In a navigation system, since a user is made to grasp the path which goes to the desired destination, it is possible to set up an optimal path beforehand by predetermined actuation of an input unit 19. As a result of decision of step S3, when an optimal path is setting ending, it progresses to (step S3; YES) and step S4, and when an optimal path has not been set up, it progresses to (step S3; NO) and step S5.

[0080] In this operation gestalt, while stopping the amount of data of the map data transmitted to some extent on the occasion of the transfer control by the transfer control-interface section 30, in order that usability may transmit effective high map data, the block field made applicable to a transfer according to a self-vehicle location is appointed. It corresponds, when appointing the block field where this block field set and those with two kind and step S4 met the optimal path as a direction as a candidate for a transfer, and when step S5 appoints the block field around a self-vehicle location as a candidate for a transfer, it corresponds.

[0081] Drawing 6 is drawing showing an example of the block field which serves as a candidate for a transfer by step S4. Here, since it is easy, it sees from a car, and 5 blocks is considered in a longitudinal direction and a total of the 15-block range of 75 blocks is considered to a lengthwise direction.

[0082] As shown in drawing 6, the range which laps with the optimal path RT set up in the navigation system as a block field R1 used as the candidate for a transfer at step S13 is set up. That is, when the optimal path RT is searched for and set even to Destination PE from the start location PS based on desired actuation, 21 blocks to the block B21 with which Destination PE is included from the block B1 with which the start location PS is included through block B-2-B20 in the middle of an optimal path RT passing have lapped on the optimal path RT. Since the mesh-like rectangle field is considered as the block as mentioned above, based on the LAT and LONG of each point of an optimal path RT, the block which laps with an optimal path RT can be judged.

[0083] Here, the block on [RT] an optimal path may become a large number, and the block count to a hard disk 15 set as the object of one transfer processing is restricted to a predetermined number from the need of restricting the processing time which a transfer takes. For example, in the case of drawing 6 $R > 6$, the target block count is restricted to ten pieces about one transfer processing, and the field R1 in a self-vehicle location is demarcated as a candidate for a transfer in this case. As shown in drawing 6, in a field R1, a total of 10 blocks of blocks B1-B10 are contained. And the block map data corresponding to each block in a field R1 will be stored one by one in map data storage area 15a of a hard disk 15 by the transfer interface section 30. In addition, although the block count contained to a field R1 is not restricted to ten pieces, it is desirable to consider as the block count of the proper range in consideration of the time amount which transfer processing takes.

[0084] On the other hand, drawing 7 is drawing showing an example of the block field which serves as a candidate for a transfer at step S5. Here, since it is easy, the range which sees from a car and becomes a longitudinal direction from 6 blocks a total of 42 blocks in 7 blocks and a lengthwise direction is considered.

[0085] In drawing 7, while a car is located in the self-vehicle location P, when a travelling direction is above, it is equivalent to the block field to which a field R2 serves as a candidate for a transfer at step S5. That is, since the optimal path RT is not searched for unlike drawing 6, the field R2 where a car contains 16 blocks in a travelling direction front side in all comparatively in consideration of possibility of passing after short-time progress at slight width is set up. in addition, the travelling direction of a car - north, south, east and west - even if it is any, the field R2 shown in drawing 7 can be used.

[0086] A field R2 can be demarcated by distinguishing the travelling direction of the block with which the self-vehicle location P is included, and a car on the occasion of the transfer to a hard disk 15. And the block map data corresponding to each block in a field R2 will be stored one by one in map data storage area 15a of a hard disk 15 by the transfer interface section 30. In addition, the configuration and

the block count of a field R2 are not restricted to drawing 7 , and can set up the block field which has a suitable configuration and the suitable block count in the circumference of a self-vehicle location. However, as for the block field around a self-vehicle location, it is desirable to set appropriately according to the frequency of transfer processing, the size of each block, etc.

[0087] Next, after finishing step S4 or step S5, at step S6, it judges whether it is finishing [the block map data corresponding to each block of the field R1 distinguished as mentioned above or a field R2 / storing in a hard disk 15]. Since sequential storing of the block map data transmitted to map data storage area 15a of a hard disk 15 in the past is carried out, the existence of block map data predetermined by referring to the block name in order can be judged. Or a management domain is established in a hard disk 15, the flag which shows the existence of record of each block map data is written in, and you may make it refer to a flag in the case of a transfer. Although it is necessary to read the predetermined field of a hard disk 15 at this time, it can read under control of the transfer interface section 30 also in this case. In addition, about the read-out processing to a hard disk 15, it mentions later.

[0088] When the target block map data are not stored in the hard disk 15 yet as a result of decision of step S6 (step S6; NO), it moves to step S7 and block map data transfer processing is performed. On the other hand, when the target block map data are storing ending at a hard disk 15 (step S6; YES), it moves from transfer processing of step S5 to step S8, without performing.

[0089] In transfer processing of step S7, the block map data of the block for a transfer currently recorded on DVD-ROM1 are transmitted and stored in map data storage area 15a of a hard disk 15 from DVD-ROM drive 14 by control of the transfer interface section 30. Drawing 8 R> 8 is a flow chart explaining the block map data transfer from DVD-ROM1 to a hard disk 15.

[0090] In drawing 8 , the transfer command signal St is sent out from CPU11 to the transfer interface section 30 at step S11. The parameter which, and shows the data size of the data which should be transmitted is added to this transfer command signal St, respectively. [a parameter] [the read-out location of DVD-ROM1 and the writing location of a hard disk 15] In addition, since step S7 of drawing 5 corresponds to the transfer processing to one block map data, it should just make data size in the parameter added at step S11 the data size of one block map data.

[0091] At step S12, the transfer command signal St received at step S11 is changed into the command group which corresponds in the command transducer 32. The command group which consists of two or more commands Cd based on the above-mentioned interface specification as mentioned above corresponding to one transfer command signal St is generated. Moreover, to each command Cd, the identification information of DVD-ROM drive 14 or a hard disk 15 is added, and the equipment which serves as a controlled system by this is distinguished to it.

[0092] As an example of command conversion, when the transfer command signal St and Command Cd in the case of transmitting the block map data A of DVD-ROM1 (it being recorded on the logical address 1000 of DVD-ROM1, and the amount of data being 2048x32x2 bytes) to a hard disk 15 are materialized, it is as follows. Here, the memory capacity of a buffer RAM 34 is 2048x32 bytes, and the amount of data of one logic address block of DVD-ROM1 makes 512 bytes the amount of data of 2048 bytes and one logic address block of a hard disk 15.

[0093] At this time, the transfer command signal St outputted from CPU11 is the command of "reading 2048x32x2 bytes of block map data A from the logical address 1000 of DVD-ROM1, and writing in the logical address 2000 of a hard disk 15." The transfer command signal St received by the transfer control section 31 is sent to the command transducer 32, is here and generates two or more following commands Cd.

**** Read 2048x32 bytes (32 blocks) of map data from the logical address 1000 of DVD-ROM1.**

**** Write 512x128 bytes (128 blocks) of map data in the logical address 2000 of a hard disk 15.**

**** Read 2048x32 bytes (32 blocks) of map data from the logical address 1032 of DVD-ROM1.**

**** Write 512x128 bytes (128 blocks) of map data in the logical address 2128 of a hard disk 15.**

[0094] The command group of these ****s - **** is sent to the disk side interfaces 41 and 42 through the transfer control section 31 and the host side interface 35. If it performs in order of ****->**->**->**** and

all the commands Cd are executed, the transfer to a hard disk 15 from DVD-ROM1 of the block map data A will complete Command Cd.

[0095] On the other hand, at step S13, the transfer control section 31 initializes the address generation section 33. That is, the start address of the storage region of a buffer RAM 34 is set, and the block map data which should be transmitted are written in the address generation section 33 one by one from the start address of a buffer RAM 34.

[0096] Here, the unit amount of data transmitted by 1 time of the transfer operation from DVD-ROM drive 14 to a hard disk 15 is the maximum capacity of a buffer RAM 34. Therefore, in order to transmit block map data with the comparatively large amount of data, it is necessary to perform transfer operation of multiple times, and the number of the commands Cd with which only the part is generated by the command transducer 32 will increase.

[0097] That is, compared with the amount of data of the block map data whose memory capacity of a buffer RAM 34 is one, when small, one block map copy of data will perform a series of actuation called the writing to read-out from DVD-ROM1, and a hard disk 15 two or more times. For this reason, after changing into two or more commands Cd the transfer command signal received from CPU11 by the command transducer 32, it is made to perform transfer processing.

[0098] Next, at step S14, the lead command which directs the read-out actuation for the unit amount of data is sent out to DVD-ROM drive 14 through the host side interface 35. The parameter which shows the read-out location of DVD-ROM1 is added to this lead command.

[0099] And at step S15, via the disk side interface 41 and the host side interface 35, a part for the desired unit amount of data is transmitted among the block map data for a transfer, and this is written in the predetermined address of a buffer RAM 34 from DVD-ROM drive 14 which received the lead command sent out at step S14. The write-in address to a buffer RAM 34 is initialized for every transfer. The writing to a buffer RAM 34 is started from the address initialized at step 13, and the map data read in DVD-ROM1 are written in the location specified in the write-in address to a buffer RAM 34. At this time, the block map data (or that part) which are a candidate for a transfer are in the condition of having been held at the buffer RAM 34.

[0100] So, at step S16, the transfer control section 31 initializes the address generation section 33. That is, the start address of the map data storage field which should be read from a buffer RAM 34 to the address generation section 33 is set, and the block map data which should be transmitted to a hard disk 15 are read one by one.

[0101] At step S17, the light command which directs the write-in actuation for the unit amount of data is sent out to a hard disk 15 through the host side interface 35 that block map data should be transmitted. The parameter which shows the write-in location to a hard disk 15 is added to this light command.

[0102] And at step S18, a part for the unit amount of data of the block map data held to the predetermined address of a buffer RAM 34 is read to the hard disk 15 which received the light command sent out at step S17, and it transmits via the disk side interface 42 and the host side interface 35, and writes in the write-in predetermined location of map data storage area 15a of a hard disk 15.

[0103] Read-out to a buffer RAM 34 is started from the address initialized at step 13, and map data are read from the location specified in the read-out address from a buffer RAM 34.

[0104] Subsequently, at step S19, it judges whether read-out/writing of the block map data for a transfer were completed to a hard disk 15. As a result of decision, when read-out/writing of block map data are ended, it progresses to (step S19; YES) and step S20, and when read-out of block map data is not ended, processing of (step S19; NO), step S13 - step S19 is repeated. It is that a decision result serves as "YES" in step S19, after writing in eye N time at least.

[0105] Finally at step S20, interrupt signal Si which shows termination of transfer processing from the transfer control section 31 to CPU11 is outputted. Since interrupt signal Si is immediately recognized by CPU11, it can finish step S7 of drawing 5, and it can move from it to the processing after step S8 promptly. In addition, you may make it the transfer control section 31 set the predetermined flag which shows termination of transfer processing in step S20.

[0106] It returns to drawing 5 and judges whether the target block is still in a field R1 or a field R2 at step S8. As a result of decision, when the target block remains, in order to process step S6 - step S8 about (step S8; YES) and its block, it moves to step S6. On the other hand, when a transfer is finished about all target blocks, transfer processing of (step S8; NO) and drawing 5 is finished.

[0107] According to the navigation system which performs transfer processing concerning this operation gestalt, the block with which a self-vehicle location is included is distinguished, and the block map data recorded on DVD-ROM1 by the transfer interface section 30 are transmitted to map data storage area 15a of a hard disk 15 from DVD-ROM drive 14 by making two or more blocks around a self-vehicle on the basis of this applicable to a transfer. In this transfer processing, while changing into the command group corresponding to the interface specification of a DVD-ROM drive and a hard disk 15 the transfer command signal St received from CPU11 by the command transducer 32, it transmits, holding block map data temporarily to a buffer RAM 34 for every unit amount of data. Therefore, after it sends out the transfer command signal St, it does not need to be placed between transfer processings by CPU11, and it can transmit map data, without increasing the processing burden of CPU11. Moreover, the transfer interface section 30 can perform transfer processing, without using an internal bus 10, and does not cause trouble to other processings using an internal bus 10.

[0108] Although the above-mentioned example explained the case where the transfer interface section 30 performed map data transfer processing, according to the transfer command signal St from CPU11, CPU11 can send out a read-out command signal and a write-in command signal, as mentioned above to the transfer interface section 30 besides the transfer command signal. That is, in this operation gestalt, access to DVD-ROM1 or a hard disk 15 will always be performed via the transfer interface section 30. Hereafter, map data required for a display process etc. during navigation actuation are explained as an example in such a case using drawing 9 about the processing in the case of reading from a hard disk 15.

[0109] Drawing 9 is a flow chart which shows the processing performed when reading one block map data from a hard disk 15. Initiation of processing of drawing 9 sends out a read-out command signal from CPU11 to the transfer interface section 30 at step S21. The parameter which shows the read-out location of a hard disk 15 and the data size of the block map data which should be transmitted is added to this read-out command signal, respectively.

[0110] Next, at step S22, the transfer control section 31 initializes the address generation section 33 like step S12. Then, at step S23, the above-mentioned read-out command signal is changed into two or more commands Cd in the command transducer 32, and the command group based on the above-mentioned interface specification is generated. The identification information of a hard disk 15 is added to each command Cd.

[0111] Next, at step S24, the lead command which directs the read-out actuation for the unit amount of data is sent out to a hard disk 15 through the host side interface 35. The parameter which shows the read-out location of a hard disk 1 is added to this lead command.

[0112] And at step S25, map data storage area 15a of a hard disk 15 which received the lead command sent out at step S24 is accessed, a part for the desired unit amount of data is transmitted among required block map data via the disk side interface 42 and the host side interface 35, and it is written in the predetermined address of a buffer RAM 34. The address given to a buffer RAM 34 by the address generation section 33 becomes being the same as that of step 15 or step S18.

[0113] Subsequently, at step S26, it judges whether read-out from a hard disk 15 was completed to required block map data. As a result of decision, when read-out to block map data is ended, it progresses to (step S26; YES) and step S27, and when read-out of block map data is not ended, processing of (step S26; NO), step S24 - step S26 is repeated. In addition, when the decision result of step S26 serves as "YES", one required block map data will be in the condition of having been held at the buffer RAM 34.

[0114] Subsequently, at step S20, interrupt signal Si which shows termination of transfer processing from the transfer control section 31 to CPU11 is outputted. Since interrupt signal Si is immediately recognized by CPU11, it can move to preparation of the next processing promptly. In addition, you may make it the transfer control section 31 set the predetermined flag which shows termination of transfer processing.

[0115] Finally at step S28, the block map data currently held at the buffer RAM 34 are outputted to an internal bus 10. Then, this block map data is transmitted to the case where it is transmitted to RAM13 and used for processing of CPU11, and a display and control section 21, and may be set as the object of display processing.

[0116] In addition, although the example of drawing 9 explained the case where block map data were read from a hard disk 15, you may make it read the block map data recorded on DVD-ROM1 from DVD-ROM drive 14. For example, what is necessary is just to make it read from DVD-ROM drive 14, when required block map data have not been stored in map data storage area 15a of a hard disk 15. In this case, in step S23, it can respond by adding the identification information of DVD-ROM drive 14 to each command Cd.

[0117] Distinction of having not stored in map data storage area 15a of a hard disk 15 is performed by CPU11. CPU11 reads the directory (management information) of a hard disk 15 through the transfer interface section 30, and it judges whether block map data required for a hard disk 15 are stored. What is necessary is just to send to coincidence the purport read from DVD-ROM drive 14 to the above-mentioned read-out command at the transfer interface section 30, when there are no block map data in a hard disk 15.

[0118] Moreover, it is not restricted to transfer processing of drawing 5, and read-out processing from the hard disk 15 of drawing 9, but the transfer interface section 30 can also perform write-in processing of the data of the request to a hard disk 15. In this case, CPU11 writes in the transfer interface section 30, sends out a command signal, and should just generate the command group corresponding to a write-in command signal by the command transducer 32. By this, desired data will be written in a hard disk 15 by data flow contrary to drawing 9 via an internal bus 10, the transfer control section 31, a buffer RAM 34, the host side interface 35, and the disk side interface 42.

[0119] DVD-ROM drive 14 can be used for other applications by reading block map data from a hard disk 15, as shown in drawing 9, or navigation actuation can be continued also when it is at the disk ejection time. If the block map data the circumference of a self-vehicle location, on an optimal path, etc. are transmitted to the hard disk 15 at this time, the high block map data of utility value can be alternatively stored in map data storage area 15a to which memory capacity was restricted. And since the hard disk 15 with a high-speed access rate is used, a screen display and scrolling become a high speed and comfortable navigation actuation is performed. Furthermore, by the transfer interface section 30, block map data transfer processing and read-out processing can be shared, and configuration of a navigation system and simplification of processing can be attained.

[0120] In addition, in the above-mentioned operation gestalt, although the case where DVD-ROM1 was used as a record medium with which map data were recorded was explained, the record format to a record medium can use the various storage equipped with the interface which it is not restricted to a DVD format and adjusted in the host side interface 35.

[0121] Moreover, it is possible to realize combining the personal computer which was not restricted as a navigation system concerning the above-mentioned operation gestalt when realizing as navigation equipment according to individual, for example, was equipped with the hard disk. In this case, the function of the above-mentioned operation gestalt is realizable in operating the software which performs transfer processing of this invention in a personal computer.

[0122]

[Effect of the Invention] Since the map data recorded on the record medium were transmitted to the 2nd storage means from the 1st storage means by the transfer interface section to predetermined timing according to this invention as explained above While being able to use the 1st storage means for other applications during navigation, in the case of transfer processing The navigation system which can utilize map data effectively can be offered not occupying an internal bus and performing [apply a burden to a navigation control means, or] comfortable navigation.

[Translation done.]